

Application of Gamification in Higher Education: Training of Early Childhood and Primary Education Teachers in Ukraine

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Abstract. Over the past five years, the issue of gamification of education in Ukraine has been actively discussed in academic community, expanding through the practice of innovative teachers, and the availability of online courses using various platforms and applications. But still, in some cases, the issue of gamification is reduced to the question of preparation for interaction during a traditional game. That is why we have addressed several issues in this scientific review.

First, what is the difference between gamification of education and the use of games in the educational process. Secondly, we decided to analyse the gaming interests and preferences of young people who plan to work in educational institutions. This allowed us to outline not only the range of interests, but also to highlight the levels of student readiness to use gamification through the existing offer and develop their own game complexes for work in preschool or elementary schools. Thirdly, we analysed the market offer for primary and preschool education in terms of online exercises and applications that are comprehensive. This helped us to identify (from our point of view) a list of quality platforms and applications that are effective for development. They can be used in training as training examples for future teachers when studying teaching methods of various subjects, or used for school preparation, etc. In addition, we have partially repeated the reasons for confusion in terms and risks associated with the

implementation of international experience in the practice of Ukrainian education due to the economic, social and military-political situation. We believe that such a comprehensive view of gamification in higher education in Ukraine will allow us to expand the scope of understanding and implementation of appropriate training for use by teachers and comprehensive multi-component social development of educational game content for preschool and primary education.

Keywords: *gamification, higher education, preschool education, primary education, teacher training.*

I. INTRODUCTION

The fourth scientific and technological revolution, the "Industry 4.0", has already changed the existing spheres of human activity and formed new forms of interaction in society. In the case of changes in the educational process, we need to keep in mind the digital attributes that, with economic growth and accessibility, become part of the educational process or influence it. Particular attention should also be paid to ensuring the continuity of teaching and learning processes that began in the 2019-2020 academic year, which encouraged the use of technological resources that allowed communication and transfer of information and knowledge through instant messaging, with the most common means of communication being

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information and game videos, video conferencing, blogs, and learning platforms [1].

We can also note that among the most significant attributes of the digital world for learning are video and audio materials, video hosting, information pages, websites, blogs; gaming and development platforms; computer and mobile gaming applications and gadgets that make the information world accessible as an integral part of education and personal development.

All of these materials and forms of interaction are used by teachers to varying degrees, but the spontaneous use of digital world content outside of school and work exceeds the time spent and affects the audience that comes to the office or classroom. Therefore, paying attention to the education sector, we observe that:

- teachers who do not keep up with the progress, or have little interest in updates and information that is the primary source for their students;
- from which students read and imitate emotional reactions and behavioural patterns,
- It is becoming increasingly difficult to keep the attention of children and adolescents and to promote their harmonious development.

That is why, in this aspect of our research, the purpose was to analyse the issue of training specialists in preschool and primary education through the introduction of gamification in the educational process of higher education in Ukraine.

This goal setting allowed us to pay attention to the following components of the process of introducing gamification in teacher training and to define the objectives of the scientific review based on them:

- to explore the terminological difference between gamification of education and the use of games in the educational process;
- to analyse the gaming interests and preferences of young people who plan to work in educational institutions;
- to analyse the market offer for primary and preschool education in terms of online exercises, applications that are comprehensive and acceptable for implementation in the educational process.

II. MATERIALS AND METHODS

Based on the purpose and objectives defined for this scientific review, we have taken the following steps in the study of gamification.

Firstly, to define the terminology and differences in the perception and practical implementation of gamification of education, we analysed foreign and domestic theoretical and practical works.

The next step was to conduct a survey on the gaming interests of students. The survey was conducted in 2020-2024 as part of the Viral Questionnaire. The results presented in this scientific review relate to the second section, which dealt specifically with the gaming interests of students and their immediate environment, in which 158 people took part.

And the last step of our research concerned the issue of market supply, which we studied with the help of Ukrainian-language content offered in the public domain for use in primary education or for preschool children.

This approach allowed us to comprehensively draw conclusions on the issue of gamification in higher education in Ukraine in practice and identify areas where it is necessary to expand the work of both teachers and students to fully utilise the potential of open access technologies.

III. RESULTS AND DISCUSSION

Therefore, if we move on to terminology, the term gamification is quite common today. It is used both in the entertainment industry and in education. But for education, this term has ambiguous implications. After all, gamification involves the use of game approaches that intersect with game-based learning methods.

Thus, according to the theory, the issue of game methods in education is closely related to the game, and has the following connections with teaching methods. In particular, game teaching method can be called a specific game action that forms a way to achieve a specific learning goal, which is part of a system of activities aimed at achieving a common goal, that is, a teaching method, and game techniques can be part of both game and non-game teaching methods [2].

In addition, the game is designed to strengthen social relations between different members of society through the transmission of social values, to promote the preservation of knowledge and practices [3]. This type of activity focuses on conditions and situations aimed at reproducing and appropriating social experience, in which self-management of behaviour is developed and improved [4]. Also, the game is still considered today as an innovative educational proposal, which is a very versatile didactic resource that has great potential for the development of any topic related to the content of the curriculum, allowing to analyse the choices and decisions that children made during the game, to know and understand the socio-educational and cognitive evolution of each of them, as well as to develop their emotional intelligence and build a close relationship between teacher and student [5].

If we turn to the issue of computer games, we have a different range of terminology, such as:

- 2D-game - a two-dimensional game - a game in which two-dimensional images are used [6].
- 3D-game - a three-dimensional game - uses three-dimensional models and a three-dimensional game world [6].

In our opinion, this partially overlaps with the issues of game-based learning methods. That is why we have focused on the terminology that accompanies the process of gamification of education and presents this definition as follows:

- gamification is the use of game mechanics, aesthetics and game thinking to engage people, motivate action, promote learning and problem solving [7];

- gamification is a process related to stimulating the thinking of players using game techniques to engage users and solve problems [8];
- gamification is the use of elements of computer games outside the game activity [7];
- gamification is the transformation of the entire learning process into a game, and game-based learning is the use of a game as part of the learning process [7].

But at the same time, it is worth noting that, according to scientists, gamification is not identical to game-based learning and the concept of game should not be used as a synonym for gamification, and according to research, it is not just a game in the classroom [7], [8]. Indeed, the main purpose of gamification will never be a game, but rather the elements of a game for learning in a classroom environment will focus on developing academic aspects and a number of competences (social, civic, digital, etc.) [8].

In addition, in terms of practical application, current gamification trends cover three key areas that aim to promote

- socialisation and collaboration
- transformation of systems, services and activities;
- promotion of beneficial behaviours at the individual and societal levels [9].

Thus, we must understand that the search for simple solutions is at the heart of mixing concepts and replacing gamification processes. And, as our fellow scientists point out, back in 2014, gamification in the Ukrainian educational space was at the stage of "loss of illusions", as most of the existing solutions did not fulfil their goals. The analysis of the situation allowed us to explain this situation through excessive attention to external details (points, awards, progress bars, levels, leaderboards) of the developed courses [10], which often distracted attention from the goal and reduced motivation to learn due to the complexity of the processes of interaction with the course materials.

The described difficulties of implementation and the very concept of gamification led us to believe that this situation depends on the basic gaming level of the developers. That is, the design and accessibility of a game or course for students will depend on how often and how well teachers themselves interact with game content, and what content they choose.

That is why, in the second stage of our study, we analysed the gaming interests of 2nd year bachelor students who studied in 2020-2024. This gave us information about the involvement of future innovators and methodologists in the educational process, their awareness and understanding of modern game design and priorities in choosing an interaction system for a quality game.

A total of 158 people completed the survey. The main questions worth mentioning in the context of gamification are "Do you play games?" (the results of the distribution by age and number of participants are presented in Figure

1), "What games do you like to play?", "What is your favourite game?", "Write any one game that you would suggest to others". These questions gave us the opportunity to learn about the gaming interests of future primary school teachers. And it is these interests that encourage us to further reflect on the introduction of innovations in the educational process, the durability and prospects that await projects that are already being implemented or are just being developed for the digitalisation of education and research on gamification. In addition, the issue of students' readiness for such innovative activities has a direct impact on the next few years, in our opinion, about 10 years, of the functioning of the educational system.

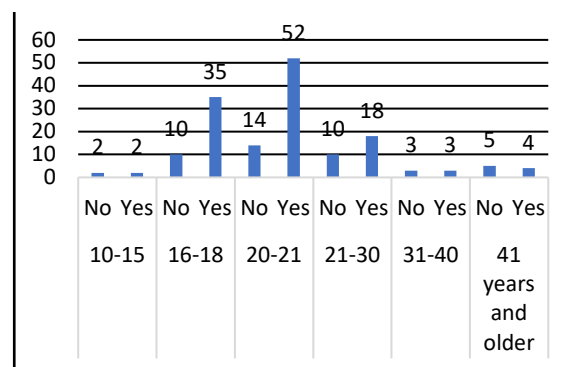


Fig. 1. Quantitative indicators of age distribution.

Therefore, the first question of this section gave us information about the number of people who perceive the gaming space and those who exclude gaming moments from their field of vision. As we can see from Table 1, the majority of students aged 16 to 21 play games, while in younger and older groups this figure is at a minimum level or tends to decrease the gap between those who play and those who do not play games.

That is why we proposed the following question: "What games do you like to play?". We added a list of answers where you could choose one or all options. Among them were the following: Outdoor games; Lying on the couch, crosswords, etc.; On the phone; On the computer; Hide and seek with the fridge; Board games; Educational/learning games. These questions were partly humorous and were intended to analyse the pattern of respondents' thinking. For the custom option, we also included a line where respondents could indicate their own option that would allow them to go beyond the templates.

For example, 7 respondents repeated the answer "I don't play games" in the other option box, one respondent added the answer "puzzles" (although this is a variant of a board game) and another option "I play with my niece". Others chose from the options that were offered. It is worth noting that 76 respondents out of 158 play games on their phones and 35 play games on their personal computers (we did not distinguish between laptops and PCs). This allowed us to say that 48% and 22% respectively have information (at least at the intuitive user level) about the issues of accessible design in the development of online courses and applications for

education. But, in our personal opinion, this figure is too low to create a critical mass in the process of innovation, including the gamification of education.

The next two questions gave us the opportunity to monitor the honesty of the respondents' answers and confirm or deny the lack of acceptance and involvement in the processes of technical and information change that will further influence the choice of methods and forms of interaction between future specialists in the classroom and their students. For example, "What is your favourite game?", "Write any one game that you would suggest to others", we analysed the elections and re-elections, and compared the game content (summarised data are presented in Table 1).

Based on the analysis, it was found that the difference between those who had no suggestions (i.e. did not choose game content) and the answers to the last two questions was 6%. This allows us to conclude that the majority of those who reported no gaming habits have not changed, and the remaining 6% are not a critical mass for changes in gamification processes.

But in any case, the data on the use of computer and mobile games suggests that the audience that has the greatest influence on gamification in education has little information about game design and its combination with educational purposes. It is also worth noting that among mobile game applications, respondents suggested such applications as Homescapes, PUGB Mobile, Club Romance, Clash royale, Talking Tom, fishdom, Garden Affairs, mobie legends, Among us, and Fortress Defence, which cannot be classified as a game-based learning environment, as this content lacks learning objectives and goals. In addition, to be used in any of the educational projects, their value for mastering certain competencies must be tested and described qualitatively. However, it is the design and accessibility issues used in the proposed games that can help teachers design and develop individual elements for the educational process. It is worth mentioning the applications proposed by respondents such as Minecraft, Block Puzzle, mahjong, puzzles (Spichki), which can be used for educational purposes and are already used in STEM education and in mathematics lessons. If we take puzzles, this element is used even in work with preschoolers.

TABLE 1. RESPONDENTS' CHOICE OF GAMING MATERIALS

Respondents' choice	Questions	
	<i>What is your favourite game?</i>	<i>Write any one game that you would suggest to others</i>
	<i>Total choices summarised</i>	
Moving games	24	13
Board games	78	82
Mobile games	13	13
Computer games	18	13
None	34	39
Total choices	167	168

The next set of suggestions is computer games. Among them, respondents suggested shooters (Dota 2, Counter-Strike, GTA, Witcher 3, The Matrix, PUGB, WOT Tanks, Mafia 2, League of Legends, Total War, Stalker, Lineage 2, Far Cry 3), racing, strategies (Farm, The Sims, and adventure Subnautica, Fire and Water. But

this content is also largely unusable in the educational process, as it does not contribute to socialisation or the promotion of useful behaviours at the individual and societal levels.

This is what brought us back to the problems in interpreting gamification, i.e. to the first question. Although educational games are favoured in the game content of board or mobile games, the potential of video games, apps or gaming applications is not much considered in terms of socialisation, behaviour, emotional responses, etc. However, as video games begin to gain more and more recognition, going beyond the entertainment function, gaining importance as an art form and as a means of learning, influencing or informing and contributing to the emergence of "Serious Games" [11] According to researchers and scientists, such a game is a computer program that consistently combines both serious aspects, such as learning or communicative intentions, and game elements of video games, such as cooperation, competition and strategy, aimed at improving users' skills, activity and productivity [12]. For example, when creating the concept of serious games, developers rely on the capabilities of traditional games (card and board games) in optimising learning in educational institutions in complex societies to combat school failure, as they improved motivation and connected educational content with the real world through game modelling, which facilitated the transition from theoretical to practical implementation of scenarios with analogue, digital games or mixed proposals and allowed us to observe positive changes in the development of the value-motivational, cognitive and activity-reflective components of students' learning activities [13].

It is also worth mentioning that simulation with elements of gamification is competence-based and aimed at engaging students in various activities to create learning intrigue and maintain student concentration, interest and motivation to learn [14]. The markers that should be used when selecting game applications for gamification of the educational process can be taken as those identified by the team of scientists as those that may limit the use of simulation games:

- inconsistency with reality;
- the players' decisions lack responsibility;
- impossible without spatial and hardware resources;
- learning takes place in a limited game environment;
- participants often treat games as entertainment, but not as learning;
- there is a significant difference in the behavioural patterns of participants when they are in a game and in real life [14].

These are exactly the aspects that we partially mentioned when describing the proposed gaming applications and computer games by our respondents. In addition, in this part, in our opinion, it is necessary to keep in mind the growing role of the teacher, who, in addition to teaching new material, takes on additional functions of a consultant, coordinating the educational and cognitive process and constantly improving their own courses and

systematically improving their own qualifications in accordance with innovations [15].

Based on the selected tips for selecting content for gamification of the educational process, we considered the availability of comprehensive Ukrainian-language offers of educational content for children. As a result of communication with students, we found out that there is no comprehensive approach to using apps. Most young teachers use exercises developed for a specific subject by innovative teachers or their colleagues, which are posted on the Lerningapp and word wall gaming platforms. Or analogues of game content posted on the portals Vseosvita, OsvitaUA, Na urok, etc. that can be printed and used in the classroom without the use of technology.

While searching for options on the Internet, we came across the LogicLike website, which offers a range of developments from multi-level games to specific tasks for developing thinking or related to specific subjects. The products can be used for both preschoolers and primary school students. Vivid images and accessibility are certainly not the only example of complexity in the context of education and gamification today, but this example can help teachers develop games in accordance with the goals and objectives of learning, in accordance with the competencies that students should acquire and without crossing the fine line between education and entertainment.

Another thing we noticed while searching for content was the lack of Ukrainian platforms for developing such a set of materials. Whereas in the English-speaking world, teachers and others are offered information and sources for developing their own resources, such as on the websites of eLearning Industry, GoodWorkLabs, Yellow, etc.

IV. CONCLUSIONS

The analysis of information on the gamification of education cannot, of course, answer all the questions related to changes and innovations in education, but we have revealed the question of why the content is being replaced and the concepts of gamification of the educational process and game-based learning methods are being substituted.

In our opinion, the market offer for primary and pre-school education in terms of online exercises and applications that are comprehensive and acceptable for implementation in the educational process is not complete and requires a deeper analysis and a separate presentation. But at the same time, this did not prevent us from making a better presentation of the gaming interests and preferences of bachelor's students in 2020-2024 who plan to work in educational institutions. This allowed us to identify the limitations to the use of game content, including its relevance to real-life situations, its impact on socialisation, behaviour and emotions of the student, the lack of a boundary between the entertainment context of the game and its educational purpose, the reduction of educational value in the game, etc. that may affect the quality of the educational process.

Thus, we analysed the issues that were the focus of this study. We have presented positive and negative trends that have a direct impact on the educational process in the training of future primary school teachers and preschool teachers. And which, in turn, affect the implementation of gamification directly in first-level educational institutions. This allowed us to outline the main possibilities of adapting gamification in higher education for the training of preschool and primary education teachers in Ukraine.

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